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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Terrestrial digital multimedia broadcasting (T-DMB) receivers –
Part 1: Basic requirement

Récepteurs pour diffusion multimédia numérique terrestre (T-DMB) –
Partie 1: Exigences fondamentales

IEC 62516-1:2009

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CONTENTS

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TERRESTRIAL DIGITAL MULTIMEDIA BROADCASTING (T-DMB) RECEIVERS –

Part 1: Basic requirement

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This bilingual version, published in 2009-05, corresponds to the English version.

The text of this standard is based on the following documents:

FDIS	Report on voting
100/1490/FDIS	100/1521/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

TERRESTRIAL DIGITAL MULTIMEDIA BROADCASTING (T-DMB) RECEIVERS –

Part 1: Basic requirement

1 Scope

This part of IEC 62516 specifies the characteristics and minimum required performance for terrestrial digital multimedia broadcasting (T-DMB) receivers. The contents of this standard include T-DMB system information, video, audio, and MPEG-4 BIFS data.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62104:2003, *Characteristics of DAB receivers*

ISO/IEC 10918-1, *Information technology – Digital compression and coding of continuous-tone still images: Requirements and guidelines*

ISO/IEC 11172-3, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s – Part 3: Audio*

ISO/IEC 13818-1:2000, *Information technology – Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-3:1998 *Information technology – Generic coding of moving pictures and associated audio information – Part 3: Audio*

ISO/IEC 14496-1:2001, *Information technology – Coding of audio-visual objects – Part 1: Systems*
Amendment 3 (2003)

ISO/IEC 14496-3, *Information technology – Coding of audio-visual objects – Part 3: Audio*

ISO/IEC 14496-10, *Information technology – Coding of audio-visual objects – Part 10: Advanced Video Coding*

ISO/IEC 14496-11:2005, *Information technology – Coding of audio-visual objects – Part 11: Scene description and application engine*

ISO/IEC 15444-1, *Information technology – JPEG 2000 image coding system: Core coding system*

ITU-T Recommendation H.264, *Advanced video coding for generic audiovisual services*

ETSI TR 101 496-2, *Digital Audio Broadcasting (DAB); Guidelines and rules for implementation and operation – Part 2: System features*

ETSI TS 102 427 V1.1.1, *Digital Audio Broadcasting (DAB); Data Broadcasting –MPEG-2 TS streaming*

ETSI TS 102 428 V1.1.1, *Digital Audio Broadcasting (DAB); DMB video service; User Application Specification*

ETSI EN 300 401 V1.3.3, *Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
T-DMB receiver
terminal that can receive and process the programs transmitted following this T-DMB receiver standard

3.1.2
minimum required performance
lowest performance level allowed for a receiver in order to be called a T-DMB receiver

3.2 Abbreviations

AAC	Advanced Audio Coding
ASO	Arbitrary Slice Order
AU	Access Unit
AV	Audio/Video
AVC	Advanced Video Coding
BIFS	Binary Format for Scene
BSAC	Bit-Sliced Arithmetic Coding
CAVLC	Context Adaptive Variable Length Coding
CTS	Composition Time Stamp
CIF	Common Interchange Format
DAB	Digital Audio Broadcasting
DP	Data Partitioning
ES	Elementary Stream
FIC	Fast Information Channel
FMO	Flexible Macroblock Ordering
IMDCT	Inverse Modified Discrete Cosine Transform
IDR	Instantaneous Decoder Refresh
IOD	Initial Object Descriptor
IP	Internet Protocol
JPEG	Joint Photographic Experts Group
MCI	Multiplex Configuration Information
MOT	Multimedia Object Transfer
MPEG-2	Motion Picture Experts Groups-2
MPEG-4	Motion Picture Experts Groups-4
MS	Mid/Side
MSC	Main Service Channel
NAL	Network Abstraction Layer
OCR	Object Clock Reference
OD	Object Descriptor
OFDM	Orthogonal Frequency Division Multiplexing
OTB	Object Time Base
OTC	Object Time Clock
PAT	Program Association Table
PCR	Program Clock Reference
PCM	Pulse Code Modulation
PES	Packetized Elementary Stream

PID	Program IDentifier
PMT	Program Map Table
PNG	Portable Network Graphics
PNS	Perceptual Noise Substitution
PS	Parametric Stereo
PSI	Program Specific Information
PTS	Presentation Time Stamp
QCIF	Quarter CIF
QMF	Quadrate Mirror Filter
QVGA	Quarter VGA
RS	Redundant Slice
RS-coded	Reed-Solomon coded
SBR	Spectral Band Replication
SEI	Supplement Enhancement Information
SI	Service Information
SL	Synchronization Layer
ScF-CRC	Scale Factor Cyclic Redundancy Check
STC	System Time Clock
T-DMB	Terrestrial Digital Multimedia Broadcasting
TNS	Temporal Noise Shaping
TS	Transport Stream
TwinVQ	Transform domain Weighted Interleave Vector Quantization
VCL	Video Coding Layer
VGA	Video Graphics Array
WDF	Wide DMB Format

4 Summary of receiver implementation

4.1 General

This part of IEC 62516 provides the characteristics and minimum required performance specifications necessary in implementing T-DMB receivers in order to minimize flaws due to misunderstandings of the relevant standard. This clause provides just a summary of this specification. Normative characteristics and requirements are provided in detail in Clauses 5 to 10.

4.2 Basic operation of a T-DMB transmitter

As shown in Figure 1 the T-DMB system is an extension of the existing DAB system by adding a video multiplexer before the stream mode channel.

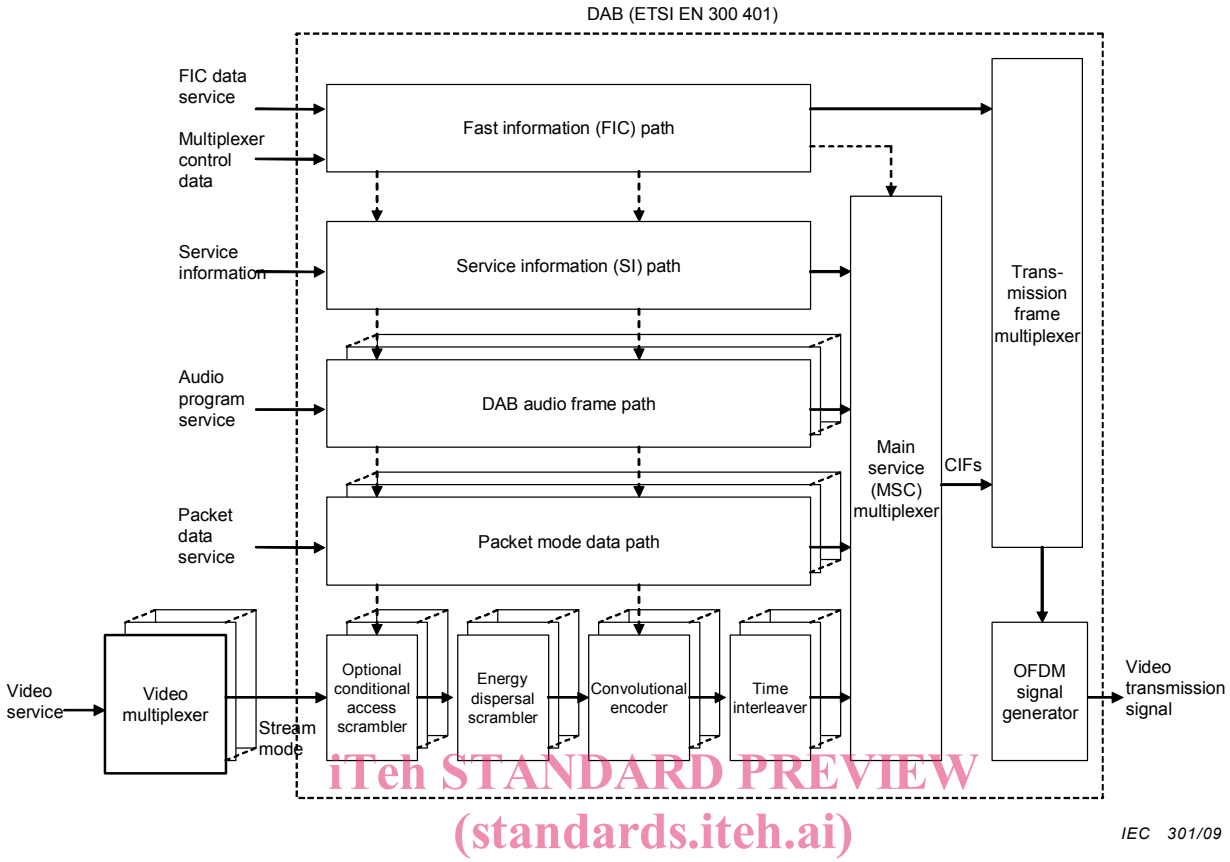

Figure 1 – Conceptual transmission architecture for the video services

Figure 2 shows the conceptual structure of the video multiplexer including an IOD generator that provides the information on system initialization, an OD/BIFS generator that provides information on scene composition using objects, and AV encoders that generate audio/video compressed streams. The IOD, OD, BIFS, compressed AV data, and auxiliary data are packetized and multiplexed into a RS-coded MPEG-2 TS. The RS code is included here for maintaining the multiplexed video data at a higher quality than those of existing DAB signals.

For each of the video, audio, and data services provided by the video multiplexer in Figure 2, this standard specifies characteristics and requirements that are needed in implementing a receiver that supports such services.

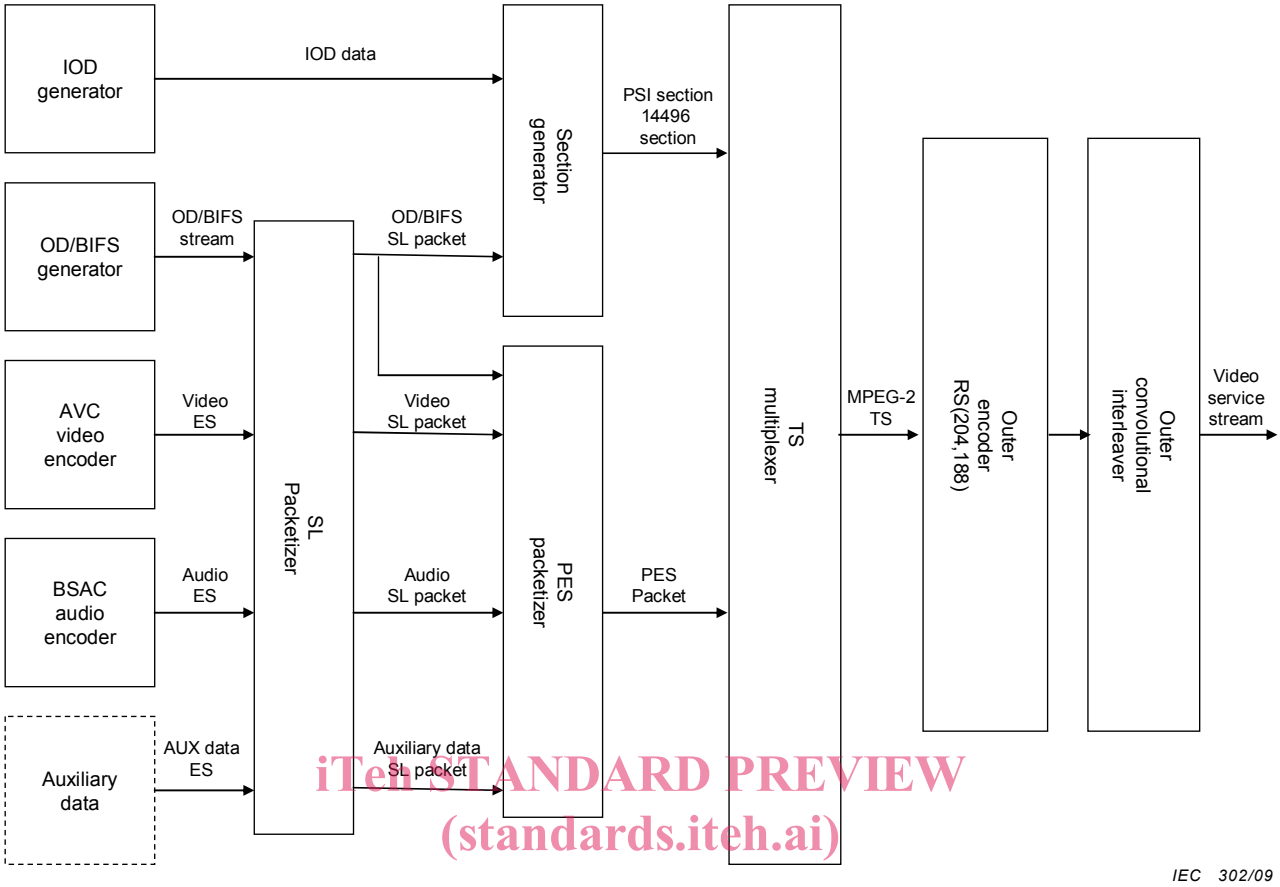

Figure 2 – Conceptual architecture of the video multiplexer

4.3 Functional requirements

Information on receiver implementations is provided on a technical basis by the descriptions and requirements on the items needed for the implementation of T-DMB receivers.

Various operational situations are defined such as service switching situations within an ensemble and between ensembles.

4.4 Summary of audio service

In this standard, the audio service is related to the implementation of a receiver compatible with the DAB audio, i.e. MUSICAM. For the audio service, IEC 62104 can be referred to without making any further specifications. IEC 62104 classifies system functions, performance requirements, interfaces, minimum performance specifications and its measurement method and gives as requirements audio decoder, automatic mode selection, service selection, receiver operation on multiplex reconfiguration, automatic switching to another ensemble, etc. It has specifications for each of the interfaces that are divided into RF inputs, analog and digital audio interfaces, and coded audio interfaces. For minimum performance specifications and measurement methods, it specifies bit-error ratio (BER), selectivity, minimum input power, sensitivity with their measurement methods.

Mandatory characteristics and requirements for T-DMB and audio services are described in 5.1 and 5.2.

4.5 Summary of video service

In this standard, the video service is defined as in the T-DMB standards, i.e. ETSI TS 102 427 and ETSI TS 102 428, and is related to the implementation of a receiver compatible with a service composed of a video (H.264), audio (BSAC or HE-AAC V2) and multimedia data (BIFS, Images) in stream mode.

Clause 5 gives additional requirements to those already specified in ETSI TS 102 427 and ETSI TS 102 428. Clause 6 explains the timing information related to the AV synchronization. Clauses 7, 8, and 9 define requirements for video decoders, audio decoders, and BIFS, respectively.

4.6 Summary of data service

The data service is related to the implementation of a receiver compatible with the T-DMB data services including MOT slideshow and broadcast website service that use MOT, transparent data channel, and IP datagram tunnelling protocols. The data service is outside the scope of this document.

5 Requirements on receiver implementations

5.1 T-DMB service selection and basic requirements

The main service channel and the fast information channel (FIC) deliver service components and MCI, respectively. A service is composed of one or more service components and multiple services can be delivered in an ensemble.

Users of T-DMB receivers get access to a service component by selecting a service. Primary component is a mandatory service component in a service, whereas the other remaining service components are secondary components. These two components should be distinguished.

A T-DMB receiver shall meet the following basic requirements:

– a T-DMB receiver shall appropriately process the MCI for the access to the service desired;
– a T-DMB receiver shall abide by the terms in ETSI TR 101 496-2 regarding multiplex reconfiguration;
– a T-DMB receiver shall have the function of automatically switching to another ensemble in order to process the “service following” of T-DMB services. The “service following” is defined in ETSI TR 101 496-2;
– audio shall be muted when a scrambled service component cannot be processed.

5.2 Audio service requirements

Audio service requirements are the same as those specified in IEC 62104. This document does not provide additional requirements on audio services and the rest of this clause is only a summary of the requirements in IEC 62104.

The audio decoder for the T-DMB audio service shall conform to the subset, as defined in ETSI EN 300 401 and ISO/IEC 11172-3. As defined in ETSI EN 300 401, it is recommended that an audio decoder supports error concealment based on scale factor cyclic redundancy check (ScF-CRC). If an audio data stream is not decoded for some reason, a T-DMB receiver shall force the audio muted. The audio decoder shall be able to decode T-DMB audio streams corresponding to both 24 kHz and 48 kHz sampling frequencies. The audio decoder shall be compatible with ISO/IEC 11172-3 and ISO/IEC 13818-3 and the processing of 256 kbps streams is optional.

5.3 Video service requirements

5.3.1 General

The T-DMB standards, i.e. ETSI TS 102 427 and ETSI TS 102 428 were written based on the requirements as described below. These requirements are derived assuming an ideal receiver that supports a video service and, for correct operations of T-DMB receivers, shall be fulfilled by transmitters when streams are transmitted. A T-DMB receiver should be designed assuming that transmitted streams fulfil these requirements.

5.3.2 Video objects

Since a service component coded by H.264 compression algorithm is provided with maximum spatial resolution of 101,376 pixels and maximum temporal resolution of 30 fps (frames per second), a receiver must be able to process it up to the maximum resolution. The maximum number of pixels is calculated as 352 × 288 based on the typical 352 × 288 format. A receiver shall support other formats defined in ETSI TS 102 428, which have pixel counts less than or equal to the 352 × 288 format.

5.3.3 Audio objects

Since a service component coded by MPEG-4 BSAC or HE-AAC V2 compression algorithm is provided with maximum sampling rate of 48 kHz, a receiver should be able to process it up to the maximum sampling rate.

5.3.4 Auxiliary data objects

Though a service component coded by the scene description and graphics data specification of MPEG-4 BIFS, JPEG, JPEG-2000 or PNG must be provided in a way allowing random access in units of 0,5 s, its processing is optional and thus receivers except for those that allegedly support it are allowed not to process it.

5.3.5 Delays between objects

Because a conformant transmitter ensures that the delay between a video object AU with CTS and the corresponding audio object AU lies within −20 ms to +40 ms when an audio object time is measured relative to that of the corresponding video object, a receiver must be able to present an audio object either up to 20 ms earlier or up to 40 ms later than the corresponding video object. In case of auxiliary data that should be synchronized with AU, because a conformant transmitter ensures that the delay between auxiliary data and the corresponding video object lies within −300 ms to +300 ms when auxiliary data time is measured relative to the corresponding video object, a receiver must be able to present auxiliary data either up to 300 ms earlier or up to 300 ms later than the corresponding video object.

5.4 Receiver channel switch time and initial access time (delay)

5.4.1 Delay

In the case of a channel switch or the initial access after receiver power-up, the time that is required from the reception of the signal all the way down to the first picture on the screen is composed of the following:

– physical channel acquisition time in a tuner and decoding time in an OFDM receiving module;

– processing time of TS section data;

– time consumed in decoding a video and an audio frame and presenting the initial picture on the screen.

The required time in an ideal case is to be estimated based on the fact that the update period of the TS sections (PAT and PMT) is at maximum 500 ms and IDR frame interval of a video object is at maximum 2 s. (Refer to ETSI TS 102 428.)

5.4.2 Initial access time (delay)

The initial access time (delay) of a receiver is defined as the interval between the time when a receiver tries to receive a signal that is in good reception state (see 10.3) and the time when the first picture is displayed. It is recommended that the initial access time of a receiver is no longer than 5 s. Neither the booting time of an operating system nor the loading time of an application program is counted. If it is assumed that PAT, PMT, and IDR are processed in sequence, which is the worst case, the initial access time (delay) of a receiver is composed of the following. In extracting TS data at a tuner and an OFDM receiving module, it takes approximately 2 s. In order to find the PAT section from the buffered TS stream data, it takes maximum 500 ms. In order to find the PMT section, it takes another maximum 500 ms. In order to find the first video AU that contains an IDR frame, it takes maximum 2 s.

5.4.3 Channel switch time

The channel switch time of a receiver is defined as the interval between the time when a receiver tries to switch channels and the time when the first picture is displayed. It is recommended that the channel switch time of a receiver is no greater than 5 s in the case of switching to a video service in another ensemble and no greater than 3 s in the case of switching to a video service in the same ensemble.

5.5 Audio and video synchronization

The basis of the synchronization of a video object and an audio object in a video service is the CTS attached to each object.

5.6 Functional requirements on the interfaces of auxiliary data

The following are functional requirements on the interfaces of auxiliary data.

– If a receiver supports optional interactive services, it should be able to process auxiliary data objects upon the user input that select an auxiliary data object displayed on the screen. The devices that are used for the user inputs can be one or more among touch screen, number pad and direction keys.

– Transport stream for the interactive data service can be transmitted with maximum 3 BIFS data and OD data divided into maximum 2 ES, and the T-DMB receiver for the interactive data service should be able to handle these data.

– Because the resolution of the auxiliary data for interactive services cannot exceed that of a video object, the auxiliary data are rendered within the scope of the resolution of a decoded video object.

– The ES descriptor of additional OD and BIFS data should be allocated after the ES descriptor of OD and BIFS data.

– The OD data and BIFS data should not include the contents of the auxiliary service.

– It is recommended that the resolution and number of JPEG or PNG as the auxiliary data for an interactive service should not exceed the following specifications so that any T-DMB receiver conforming to those specifications should work properly:

  – the resolution of auxiliary data for the composition of a scene: maximum 352 × 288;

  – the number of auxiliary data for the composition of a scene: maximum 4.

6 Synchronization of objects in a T-DMB video service

This clause describes the synchronization of decoded video and audio objects in a T-DMB video service system.